
Functional description

This chapter describes ISDN BRI system functions, the operation of the Multi-Purpose ISDN Signaling Processor (MISP), the Basic Rate Signaling Concentrator (BRSC), the S/T Interface Line Card (SILC), the U Interface Line Card (UILC), and the two forms of packet handlers - external and integrated. It also describes the Digital Subscriber Loop (DSL) concepts and how to initialize and assign service attributes to ISDN BRI terminals and trunks assigned to a DSL.

ISDN Basic Rate Interface overview

ISDN Basic Rate Interface (ISDN BRI) is a digital connection that provides three digital channels. These channels consist of two 64 kbps Bearer channels (B-channels) and one 16 kbps signaling channel (D-channel). This 2B+D connection is known as a Digital Subscriber Loop (DSL). The DSL can be configured to provide line access, trunk access, or packet data transmission.

Line Access provides a digital connection from a Meridian 1 ISDN BRI card to ISDN terminals that comply with CCITT, ANSI, ETSI NET-3 (including EuroISDN), INS NET-64 (including Japan D70), National ISDN-1 (NI-1), 1TR6, and Numeris VN2 standards; examples of terminals are telephone sets, FAX machines, personal computers and video display terminals.

Trunk Access provides Meridian 1 to Meridian 1 Meridian Customer Defined Networking (MCDN)¹ Tie trunk connectivity, QSIG ISDN BRI trunk connectivity, and CO/DID trunk connectivity to local exchanges that support Numeris VN3, 1TR6, ETSI NET-3 (EuroISDN), INS NET-64 (including Japan D70), and Asia-Pacific protocols.

Note: ISDN BRI trunk access is not supported in North America.

1. MCDN is a Northern Telecom proprietary protocol.

The Meridian 1 supports both B-channel and D-channel **packet data** transmission through an external DPN-100 packet handler, or an integrated Meridian 1 Packet Handler.

B-channels and D-channel

B-channels can be automatically assigned and reassigned to different voice and data terminals in circuit-switched applications, they can be dedicated to specific terminals for packet data applications, or configured for ISDN BRI trunk applications.

For ISDN BRI line access, the ability to dynamically connect different terminals on one DSL provides more flexibility, connectivity, and service diversity than the conventional “hard wired” connections where each channel is dedicated to one terminal. The D-channel is used for signaling and low speed packet data transmission.

For ISDN BRI trunk access, one ISDN BRI trunk may be assigned to each B-channel in the 2B+D configuration. The D-channel is used for signaling.

ISDN BRI interfaces to the Meridian 1

ISDN BRI provides two types of interface to the Meridian 1 — the S/T interface or an U interface. The DSLs may be configured for either an S/T or U interface, and may be configured for either line or trunk access.

The **S/T interface** is a globally accepted standard interface. This interface is provided by the SILC line card, which supports 8 DSLs.

The **U interface** is implemented as an ANSI standard interface only (2B1Q line encoding). This interface is provided by the UILC line card, which also supports 8 DSLs.

Data link and network processing

The ISDN BRI data link and network layering processing functions are carried out by the **Multi-Purpose ISDN Signaling Processor (MISP)**, or the **Basic Rate Signaling Concentrator (BRSC)**; these functions, as well as the functions of the other system hardware, are detailed in the “Engineering guidelines” section of this document.

Note: the BRSC cannot be used for trunk access; therefore, the BRSC only performs the data link processing.

General ISDN BRI capabilities

The most important capabilities of ISDN BRI are:

- for line access
 - simultaneous voice and circuit-switched data over a single DSL
 - B-channel and/or D-channel packet data transmission over a single DSL
 - multiple physical terminals connected to a single DSL
 - multiple logical devices associated with each DSL
 - diverse ISDN-compliant third party terminals (compliant with CCITT, ANSI, ETSI NET-3, INS NET-64, National ISDN-1, 1TR6, Numeris VN2, and EuroISDN standards)
- for trunk access
 - MCDN ISDN BRI Tie trunk connectivity
 - QSIG ISDN BRI Tie trunk connectivity
 - CO/DID trunk connections to local exchanges that support Numeris VN3, 1TR6, ETSI NET-3 (EuroISDN), INS NET-64 (Japan D70), and Asia-Pacific protocols

The OSI model

ISDN standards follow the Open System Interconnect (OSI) protocol model to control ISDN functions. The OSI model defines seven layers required to perform all ISDN functions from establishing an end-to-end connection between two terminals or trunks, to making a decision about the type of application that is to be activated. Figure 1 shows the seven layer OSI model. ISDN BRI utilizes only the first three layers. These are:

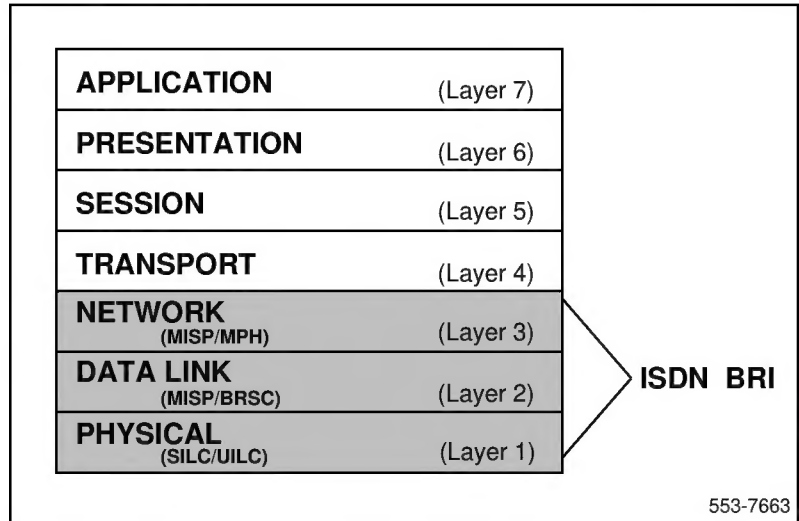
- **Physical layer** (layer 1) that provides a network-to-terminal or trunk connection (**SILC/UILC**).
- **Data link layer** (layer 2) that provides signaling used to establish a communication link between terminals or trunks over ISDN (point-to-point signaling for terminals, and point-to-multipoint signaling for trunks). It also performs some error checking and error recovery (**MISP/BRSC**).

Note: the BRSC applies to terminals only.

- **Network layer** (layer 3) that controls initialization procedures and assigns service attributes to terminals and trunks. It also controls the call processing procedures (**MISP, MPH**).

Once these three layers are established, the functional role of ISDN BRI in the OSI protocol sequence is complete. The higher layers of the OSI protocol model are handled by the end-user application software.

Figure 1
OSI model



ISDN BRI line access

ISDN BRI line access provides 2B+D ISDN service to terminating equipment such as ISDN telephone sets and data terminals. ISDN BRI line connections are configured on a per DSL basis, that is, DSL line connections may be configured on any given DSL for any SILC or UILC.

The B-channels are dynamically assigned to different voice and data terminals in circuit-switched line applications. In case of packet data applications, the B-channels are dedicated connections. The D-channel is used for signaling and dynamic D-channel packet data.

S/T interface configured for line access

Figure 2 illustrates a typical ISDN BRI configuration showing a Meridian 1 with an ISDN BRI S/T interface and the ISDN BRI terminals connected to it; the terminals must comply with CCITT, ANSI, ETSI NET-3 (including EuroISDN), INS NET-64 (including Japan D70), National ISDN-1, 1TR6, and Numeris VN2 standards.

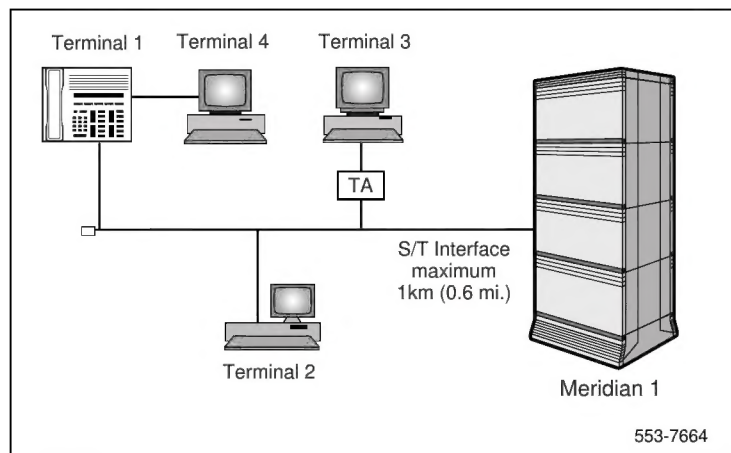
The S/T interface is a four-wire, polarity-sensitive interface which, configured for line application, can support eight physical voice and data terminals, and up to 20 logical terminals on one DSL. A physical terminal is any device directly connected to a DSL. The terminals labeled 1, 2 and 3 in [Figure 2](#) are physical terminals.

A logical terminal (terminal 4 in [Figure 2](#)) is any terminal that can communicate with the Meridian 1 over a DSL. It may be directly connected to the DSL through its own physical termination or it may be indirectly connected through a common physical termination. Please refer to Figure 27 in the “Terminal addressing and service profile assignment” section of the Engineering Guidelines chapter for an illustration of how a single physical termination may actually connect multiple logical terminals. All of the logical terminals connected to the DSL share the two B-channels provided by the S/T interface.

Note: The Terminal Adapter (TA) that is shown in the illustration is used to adapt non-ISDN BRI terminals to ISDN BRI line interface standards.

The length of an S/T interface DSL depends on the specific terminal configuration and the DSL wire gauge, however, it should not exceed 1 km (3280 ft).

Figure 2
ISDN Basic Rate Interface S/T interface configured as a line



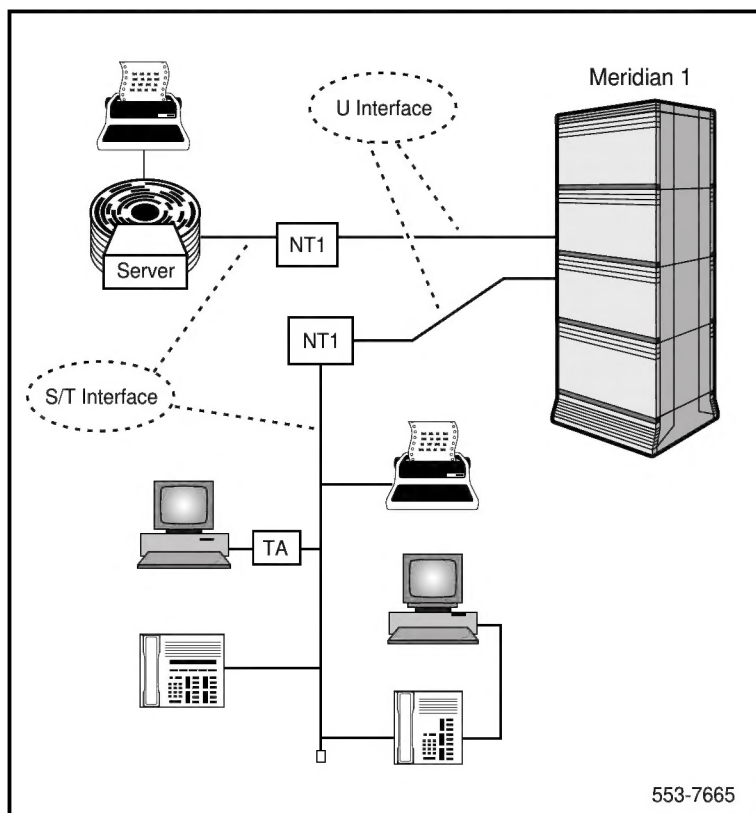
U interface configured for line access

The U interface is a two-wire interface that provides point-to-point connection over a DSL. Each U interface provides two B-channels and one D-channel and supports only one physical termination. This termination may be to a Network Termination 1 (NT1) or directly to a single U interface terminal that contains an internal NT1. Normally this physical termination is to an NT1, which provides a conversion from a U interface to an S/T interface that allows up to eight physical terminals to be connected.

The length of a U interface DSL depends on the specific terminal configuration and the DSL wire gauge, however, it should not exceed 5.5 km (3.3 mi). When connected to an NT1 the DSL length is effectively extended to 6.5 km (3.9 mi) and utilizes the multi-terminal capability of an S/T interface.

[Figure 3](#) illustrates a typical ISDN BRI configuration showing a Meridian 1 with an ISDN BRI U interface. ISDN BRI terminals can be connected to the NT1 through the S/T interface; the terminals must comply with CCITT, ANSI, ETSI NET-3 (including EuroISDN), INS NET-64 (including Japan D70), National ISDN-1, 1TR6, Numeris VN2 standards), and Asia-Pacific protocols.

Figure 3
ISDN Basic Rate Interface U interface configured as a line

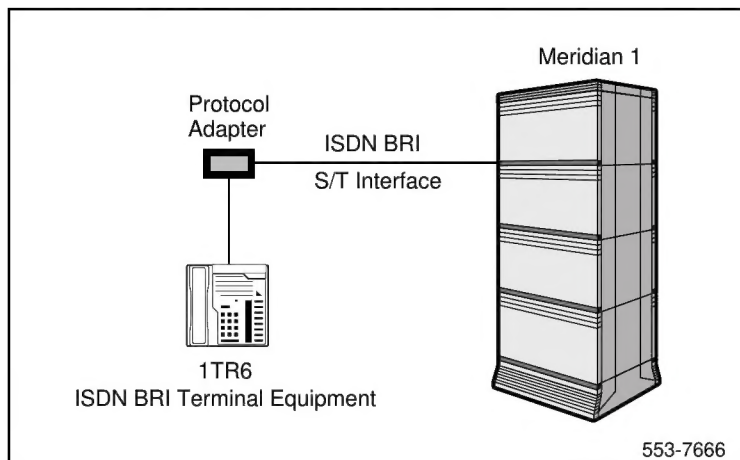


1TR6 terminal connectivity

1TR6 terminals may be connected to the Meridian 1 via a protocol adapter, which has been specifically designed to interface with Meridian 1 ISDN BRI and 1TR6 terminals. Its main function is to convert the 1TR6 protocol sent from the 1TR6 ISDN Terminal Equipment into the European Telecommunication Standard Institute (ETSI) protocol required for ISDN BRI, and vice versa. This conversion is necessary because the layer 3 requirements for 1TR6 and ETSI are different.

[Figure 4](#) shows a 1TR6 ISDN BRI terminal connected to the protocol adapter, which is used to access the Meridian 1 through an S/T interface.

Figure 4
ISDN BRI/1TR6 terminal connectivity



ISDN BRI Packet data transmission

ISDN BRI on the Meridian 1 supports both B-channel and D-channel packet data transmission. Packet data transmission is done using either an external packet handler, via Northern Telecom's Data Packet Network (DPN-100), or the integrated Meridian 1 Packet Handler (MPH).

Packet data transmission using the DPN-100

D-channel packet data transmission

D-channel packet data from each DSL is transmitted to the MISP or BRSC for separation. The MISP or BRSC separates the packet data from signaling and transmits the packet data to the ISDN PRI. From the ISDN PRI, the data is transmitted to the external packet handler over 64 kbps clear channels.

If the system is to uniquely identify the transmitted and received D-channel packet data for each terminal on a DSL, the Meridian 1 must use an internal identification number. This identification number is called Logical Terminal Identifier (LTID), which must be used together with the Logical Terminal End-point Identifier (LTEI) number during ISDN BRI configuration to uniquely define a logical terminal on a DSL. The LTEI is configured in Overlay 27.

D-channel packet data service is determined separately for each MISP or BRSC during ISDN BRI service configuration.

B-channel packet data transmission

The B-channel packet data from each DSL is sent over dedicated connections to the ISDN PRI. A dedicated ISDN PRI B-channel handles the B-channel packet data between the ISDN PRI and the DPN-100 external packet handler. The number of dedicated B-channel connections is limited to the number of available ISDN PRI channels.

The B-channels on a DSL are dedicated to the packet data transmission by assigning the packet mode data call to one or more B-channels on one or more DSLs during ISDN BRI service configuration.

[Figure 5](#) illustrates the Meridian 1 external packet handling flow diagram, showing the B-channel and the D-channel packet data routes starting at the line cards and arriving at the external packet handler through dedicated B-channels and dedicated D-channels. [Figure 6](#) presents the same concept, with the addition of a BRSC.

Figure 5
Packet data transmission using the external packet handler

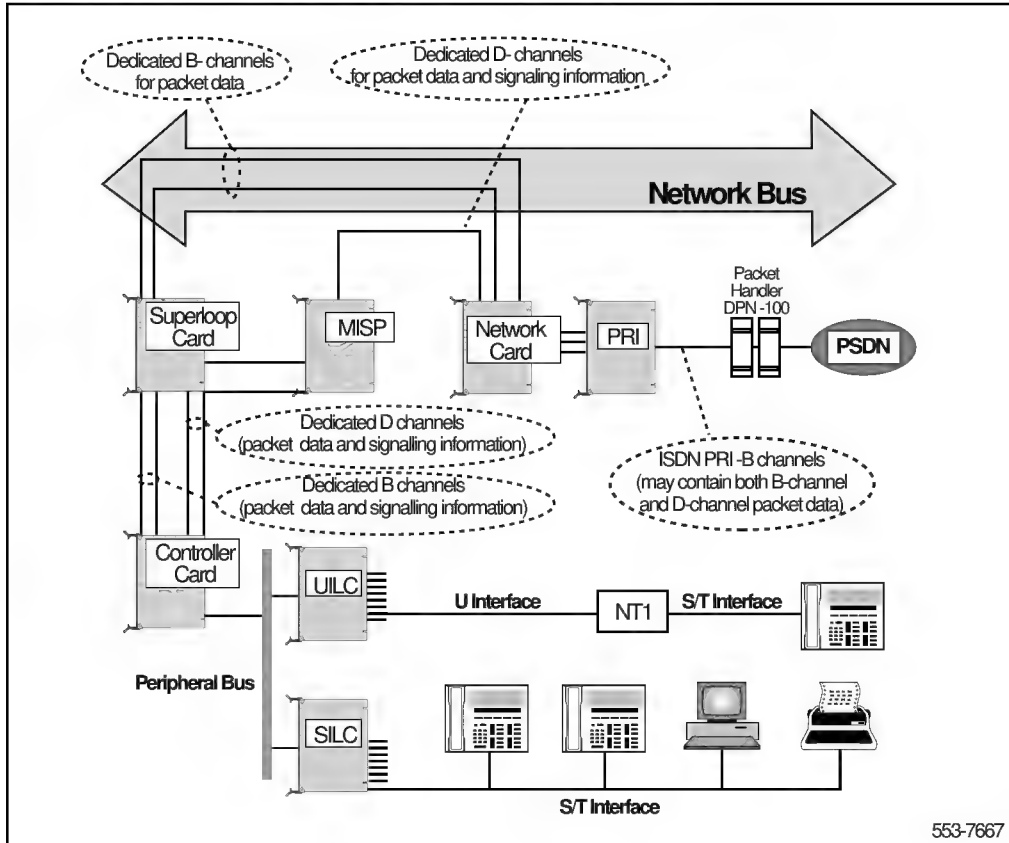
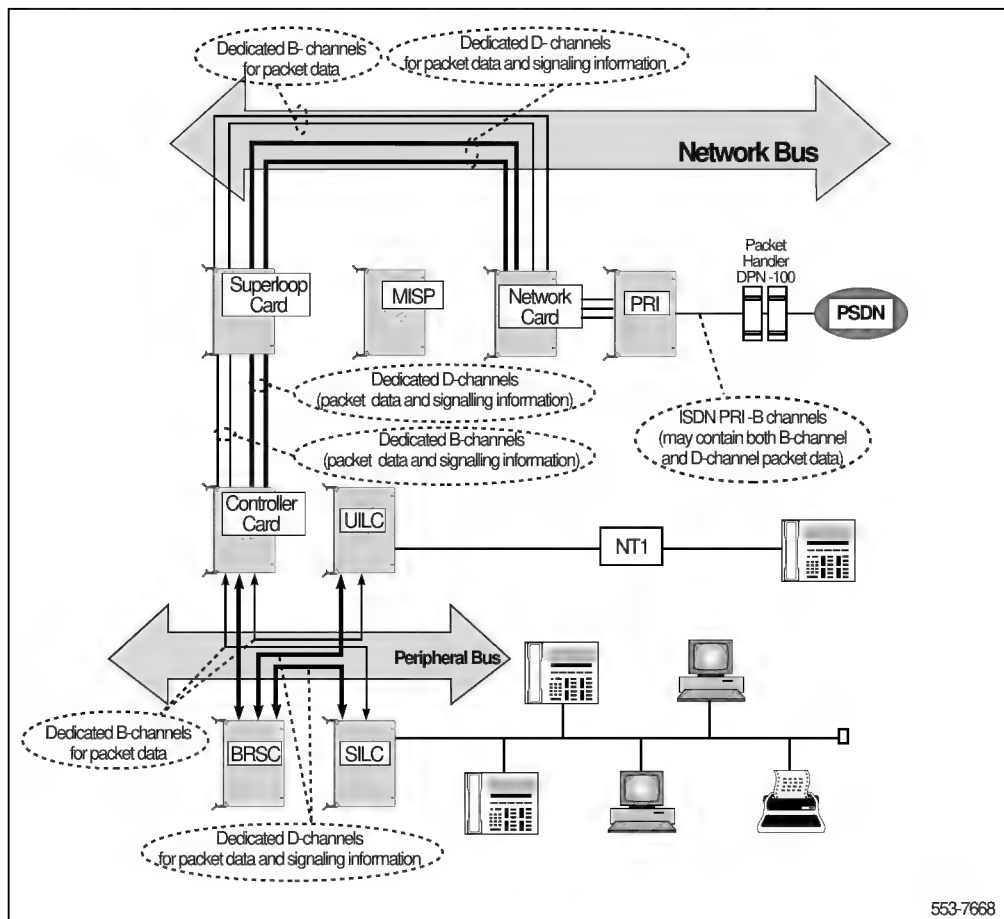


Figure 6
Packet data transmission using the external packet handler with a BRSC



Packet data transmission using the Meridian 1 Packet Handler

The Meridian 1 Packet Handler (MPH) uses a dedicated MISP as a hardware platform to run the packet handler application. Routing from the MPH to the PSDN is through dedicated connections either from a Meridian Communication Unit (MCU) data module and a synchronous modem, or from a dedicated ISDN PRI B-channel (64 kbps clear).

The MPH supports both B-channel and D-channel packet data transmission.

D-channel packet data transmission with the MPH

The MISP line application or the BRSC(s) separate the D-channel packet data from signaling and transmit the data packets on a dedicated PRI D-channel over its network connection to the MPH.

When using an MPH, the digital subscriber loop (DSL) and the Terminal Endpoint Identifier (TEI) are used to identify the Logical Terminal instead of the Logical Terminal Identifiers (LTIDs) which is used by the DPN-100 configuration.

The TEI uniquely identifies to the MPH the transmitted and received packet data for each terminal on a DSL. The TEI number is entered during ISDN BRI configuration to uniquely define a logical terminal on a DSL for the MISP. To configure a terminal for D-channel packet data service, a specific TEI is assigned to an unused static TEI and this information is sent to the MISP.

D-channel packet data service is determined separately for each MISP or BRSC during ISDN BRI configuration. When this data transmission method is selected during system configuration, the user is prompted to enter the MPH loop number to specify the dedicated connection to the MPH. The Meridian 1 CPU sets up the dedicated D-channel to the MPH and informs the MISP or BRSC on which network connection the dedicated D-channel is located.

B-channel packet data transmission with the MPH

B-channel packet data is routed to the MPH directly through dedicated connections. The MPH routes B-channel packet data to the Packet Switched Data Network (PSDN) by means of dedicated channels through either the PRI B-channel (64 kbps clear) or through a Meridian Communication Unit (MCU) with a synchronous modem.

The B-channel packet data from each DSL is routed to the Controller and Superloop network cards. From the Superloop network card, the data is sent to the MPH.

The B-channels on a DSL are dedicated to the packet data transmission by assigning the internal packet data call type to one or more B channels on one or more DSLs during ISDN BRI configuration. These dedicated channels cannot be released by the B-channel packet data terminal. The user is prompted to enter the MPH loop and channel number to specify the dedicated connection to the MPH.

Packet data transmission between the MPH and the PSDN

If using an MPH with an ISDN PRI loop, configure the ISDN PRI loop (LD17), define an ISDN customer (LD15), define a Tie trunk route for packet data (LD16), and define a Tie trunk for packet data (LD14). Then, configure the MISP for an MPH (LD27).

If using an MPH with an MCU data module, define a Tie trunk route for packet data (LD16), define a Tie trunk for packet data (LD14), and configure the MCU (LD11). Then, configure the MISP for an MPH (LD27).

Figure 7 illustrates packet data transmission for ISDN BRI line application, using the MPH.

Figure 7
Packet data transmission using the MPH

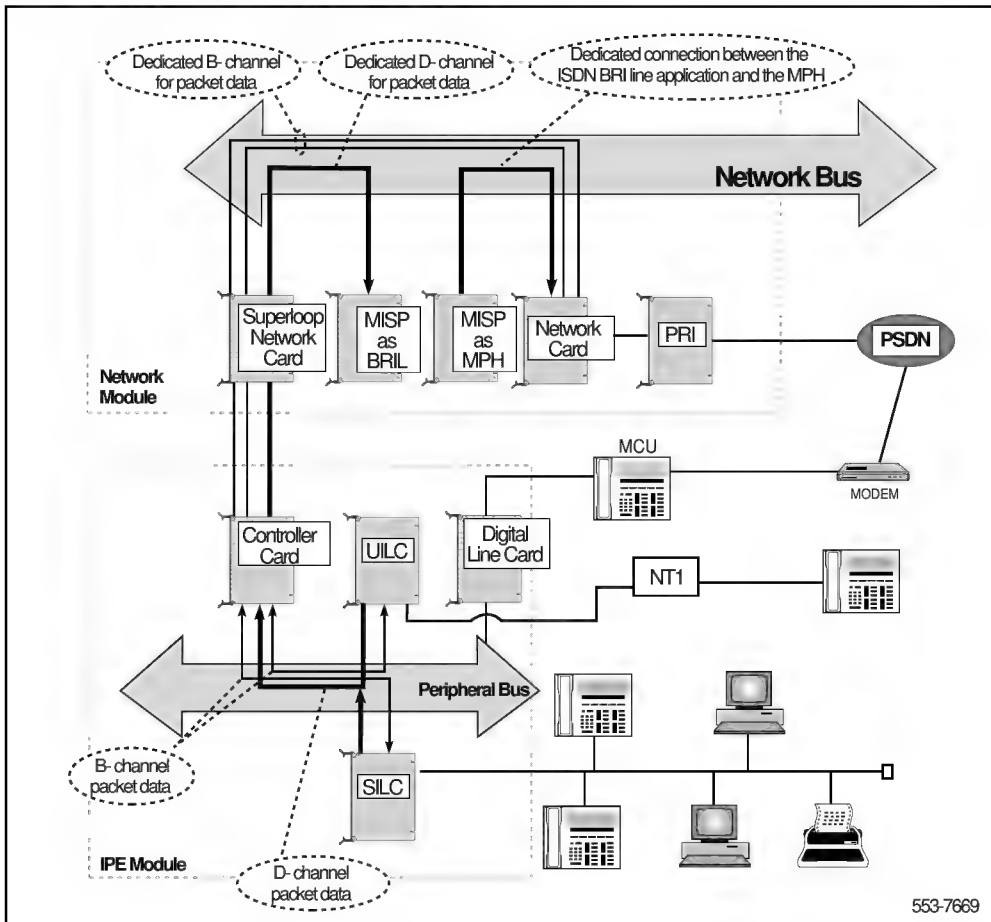
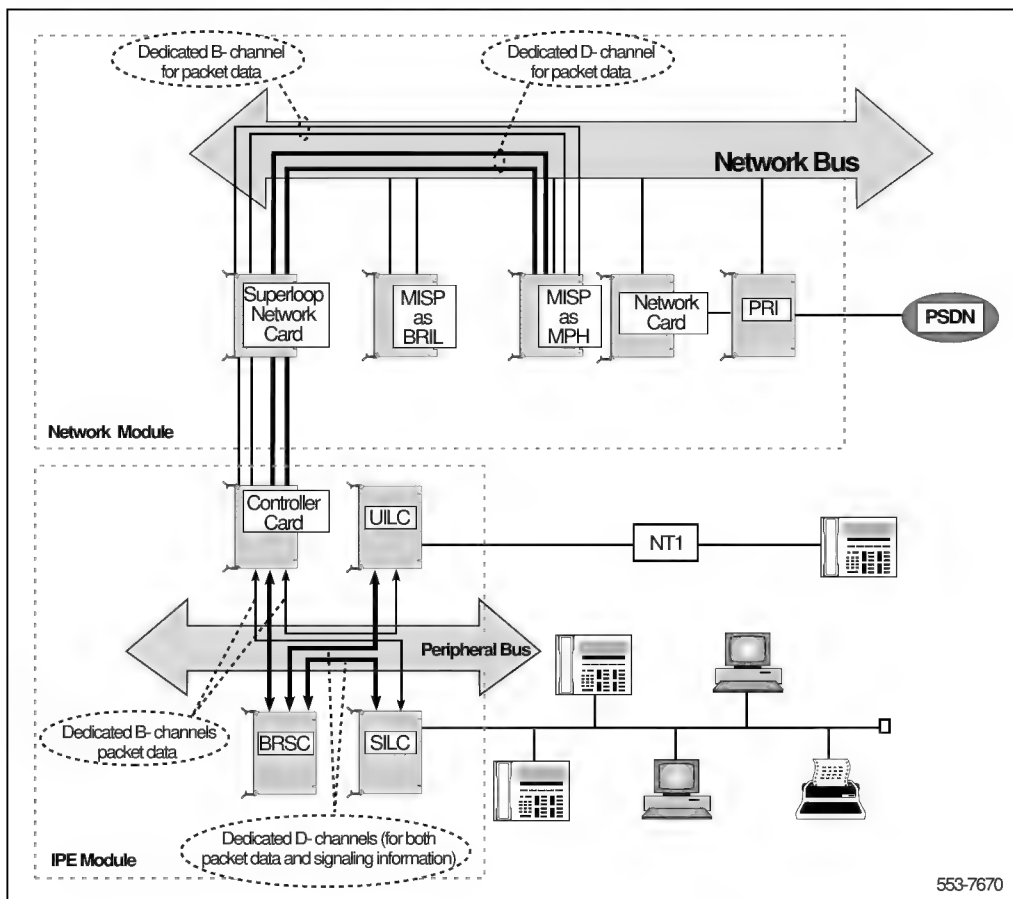


Figure 8 illustrates packet data transmission for an ISDN BRI line application, using the MPH and a BRSC.

Figure 8
Packet data transmission using the MPH and a BRSC



ISDN BRI trunk access

ISDN BRI trunks may be configured for either local exchange/CO/DID trunk connectivity, MCDN Tie trunk connectivity, or QSIG trunk connectivity. ISDN BRI trunk connections are configured on a per DSL basis, that is, DSL trunk connections may be configured on any given DSL for any SILC or UILC. The trunks can be accessed using both ISDN BRI terminals and non ISDN BRI devices (such as digital and analog telephones).

ISDN BRI Local exchange CO/DID connectivity is accomplished via a MISP card and an S/T interface, using the SILC line card. This connectivity is supported for Numeris VN3, 1TR6, ETSI NET-3 (EuroISDN), INS NET-64 (Japan D70), and Asia-Pacific protocols; refer to [Figure 9](#).

ISDN BRI MCDN Tie trunk connectivity is achieved via a MISP card and either S/T or U interfaces, using the SILC and UILC line cards respectively. This connectivity may be:

- between two Meridian 1 PBXs through a local exchange acting as a passive facility; the local exchange must support Numeris VN3, 1TR6, ETSI NET-3 (EuroISDN), INS NET-64 (Japan D70), or Asia-Pacific protocols; refer to [Figure 10](#).
- directly between two Meridian 1 PBXs; refer to [Figure 11](#) and [Figure 12](#).

ISDN BRI QSIG connectivity is achieved through an MISP card and either S/T or U interfaces, using the SILC and UILC line cards respectively. This connectivity is supported within a Private Telecommunications Network (PTN) between two Private Telecommunications Network Exchanges (PTNXs); examples may be a Centrex-to-Centrex connection, or a Centrex-to- PBX connection; refer to [Figure 13](#) in the section [“ISDN BRI QSIG connectivity” on page 41](#).

Note: The BRSC cannot be utilized for ISDN BRI trunk access.

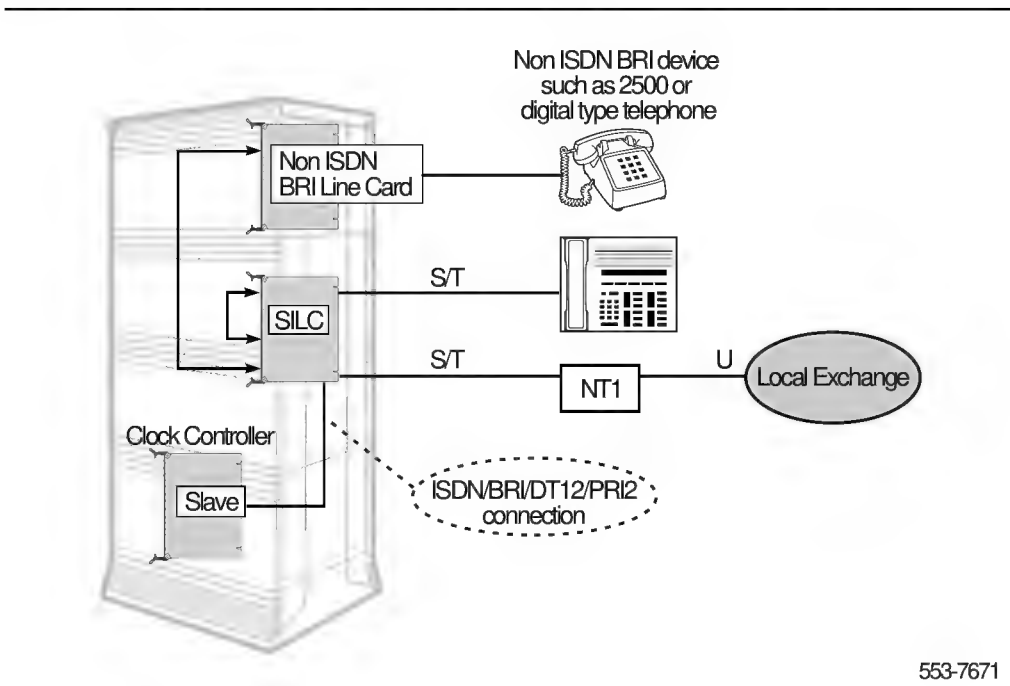
These configurations are explained in greater detail in the sections that follow.

ISDN BRI Local Exchange/CO/DID connectivity

ISDN BRI Local Exchange connectivity is supported in markets equipped with local exchanges that conform to Numeris VN3, 1TR6, ETSI NET-3 (EuroISDN), INS NET-64 (Japan D70), or Asia-Pacific protocols.

Figure 9 illustrates the ISDN BRI Local Exchange connectivity. The ISDN BRI Local Exchange DSL is connected to a Network Termination (NT1) device, which is physically located on the same premises as the Meridian 1. The NT1 device connects to the Local Exchange via a U interface. (The NT1 device is typically owned by the Local Exchange/Post Telegraph and Telephone allowing the Local Exchange/PTT to use any type of U interface, including proprietary implementations). The distance limitation of the NT1 from the Local Exchange depends on the distance supported by the Local Exchange.

Figure 9
ISDN BRI trunk access for local exchange connectivity



1TR6 local exchange connectivity

1TR6 local exchange connectivity provides 2B+D connectivity to a local exchange that supports 1TR6 protocol via an S/T interface. The ISDN BRI 1TR6 local exchange connectivity provides the following basic call and supplementary services:

Note: Support for any feature is dependent upon the terminal equipment being used.

- Basic call service
- Circuit switched voice and data on the B-channel
- Calling Line Identification Presentation and Restriction
- Connected Number Delivery
- support for TIE, COT, DID, DOD trunk types
- Channel negotiation

Note: in cases where several ISDN BRI trunks (and hence several DSLs) are configured on a route, if Channel Negotiation fails to yield an acceptable channel on any of these DSLs, it is not possible to use another channel on another DSL.

- Overlap sending
- Flexible Numbering Plan
- Indication of Call Charging to the calling party
- Network-wide interworking with ISDN BRI ETSI terminals

Numeris VN3 local exchange connectivity

The Numeris local exchange connectivity provides 2B+D connectivity through an S/T interface to a local exchange that supports Numeris VN3 protocol. The ISDN BRI/Numeris VN3 local exchange connectivity provides the following basic call and supplementary services:

- Basic call service
- Circuit switched voice and data on the B-channel
- Called/calling party subaddress (network-wide)
- Support for TIE, COT, DID, DOD trunk types
- Channel negotiation

Note: in cases where several ISDN BRI trunks (and hence several DSLs) are configured on a route, if Channel Negotiation fails to yield an acceptable channel on any of these DSLs, it is not possible to use another channel on another DSL.

- 64 kbps clear bearer capability
- Flexible Numbering Plan
- Advice of charge during call and at end of call
- Network-wide interworking with ISDN BRI Numeris terminals

Japan D70 (INS NET-64) local exchange connectivity (non-Asia Pacific protocol)

The Japan D70 (INS NET-64) local exchange connectivity (non-Asia Pacific protocol) provides 2B+D connectivity through an S/T interface to a local exchange that supports the D70 protocol (D70 is the Japanese version of the INS NET-64 protocol). The ISDN BRI/Japan D70 local exchange connectivity provides the following basic call and supplementary services:

- Basic call service
- Circuit switched voice and data on the B-channel
- Called/calling party subaddress (network-wide)
- Support for TIE, COT, DID, DOD trunk types
- 64 kbps clear bearer capability
- Flexible Numbering Plan
- Advice of charge at end of call
- Channel Negotiation

Note: in cases where several ISDN BRI trunks (and hence several DSLs) are configured on a route, if Channel Negotiation fails to yield an acceptable channel on any of these DSLs, it is not possible to use another channel on another DSL.

EuroISDN connectivity

The EuroISDN connectivity provides an interface between Meridian 1 PBXs and Central Offices/Public Exchanges that comply to the European Telecom Standards Institute (ETSI) specification ETS 300 102 for the Layer 3. The interfaces provided by this feature also comply with the country-specific Application Documents for Austria, Belgium, Commonwealth of Independent State (Russia and the Ukraine), Denmark, Finland, Germany, Holland, Ireland, Italy, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

The Meridian 1 on the EuroISDN connectivity provides the following call services, for the complying countries:

- Basic call service
- Circuit switched voice and data on the B Channel
- Calling Line Identification Presentation and Restriction (CLIP and CLIR)
- Connected Line Presentation and Restriction
- Calling and connected sub-addresses
- Support for TIE, COT, DID, and DOD trunk types
- Overlap sending and receiving
- Overlap and enbloc dialing
- Flexible Numbering Plan
- Channel negotiation

Note: in cases where several ISDN BRI trunks (and hence several DSLs) are configured on a route, if Channel Negotiation fails to yield an acceptable channel on any of these DSLs, it is not possible to use another channel on another DSL.

Asia-Pacific connectivity

This Asia Pacific Connectivity provides interface between the Meridian 1 and Public Exchange/Central Offices in the following markets:

- Australia
- China
- Hong Kong
- Indonesia
- Japan
- Malaysia
- New Zealand
- Singapore
- Thailand

The following ISDN features are supported for the Asia Pacific connectivity:

- Basic Call Service
- Calling Line Identification Presentation and Restriction (CLIP and CLIR)
- Circuit switched voice and data on the B-channel (data calls are not supported on the Hong Kong interface)
- Overlap Sending (supported by all except Japan)
- Overlap Receiving (supported by the Indonesia, China, Malaysia, and Thailand interfaces only)
- COT, DID, DOD, and TIE trunk call types, as applicable
- 64 kbps unrestricted digital information
- Channel Negotiation

Note: in cases where several ISDN BRI trunks (and hence several DSLs) are configured on a route, if Channel Negotiation fails to yield an acceptable channel on any of these DSLs, it is not possible to use another channel on another DSL.

- Flexible Numbering Plan

- PRI Route Back-up with BRI routes, and
- Sub-addressing

The following supplementary services are supported for the Australia connectivity only:

- Malicious Call Trace
- Advice of Charge (AOC) at End of Call
- Incoming Trunk Programmable CLID for analog trunks. This feature is available for use in a private or alternative carrier network, as required in Australia.

The following supplementary services are supported for the Indonesia connectivity only:

- Connected Line Identification Presentation and Restriction (COLP and COLR)
- Direct Dialing Inward (DDI/DID)

The following supplementary service is supported for the Japan connectivity only:

- Advice of Charge (considered a basic service)

Note: The Asia Pacific interface does not support the Meridian 1 Packet Handler (MPH) across the CO.

Clock synchronization, automatic switching and recovery for ISDN BRI to local exchange connectivity

System clock synchronization may be achieved by having the Meridian 1 slave to the local exchange; the clock source may be derived either from the ISDN BRI Local Exchange connection or from other ISDN BRI/PRI2/DTI2 local exchange connections if available. The clock source is input to the Clock Controller card on the Meridian 1, and the system clock is then synchronized with the network clock. This functionality is shown in [Figure 10](#).

Refer to *ISDN BRI Installation* for procedures on how to provide clock references to the Clock Controller in an ISDN BRI local exchange connectivity.

Automatic switching

The S/T software cannot detect misframes, loss of signal, and bit error rates, conditions that would cause automatic switching of the clock source; rather, the S/T relies on the clock controller to provide feedback on the quality of the clock, and performs automatic switching and recovery as appropriate. If a clock controller error is detected, the system switches to the backup clock controller, without affecting the reference clock that is being tracked.

If the SILC DSL with clock reference is disabled, and re-enabled, clock tracking is restored as follows:

- if DSL #0 has been assigned as the primary reference clock, but the clock controller is tracking on the secondary reference or is in **free run mode**, the clock is restored to tracking on primary;
- if DSL #1 has been assigned as the secondary reference clock, but the clock controller is in **free run mode**, the clock is restored to tracking on secondary.

Tracking on the primary or secondary reference clock is automatically switched as follows:

- if the system software is unable to track on the assigned primary reference clock, it switches to the secondary reference clock;
- if the system software is unable to track on the assigned secondary reference clock, it switches to **free run mode**.

Clock recovery

The SILC is configured in the slave-slave mode when acting as a trunk interface. This is set up through the Maintenance Signaling Channel (MSC). The microcontroller configures the S/T chips on the SILC as appropriate.

Automatic clock recovery is done upon the expiration of the free run guard timer. Tracking is restored to the primary reference clock, if defined. If the primary reference clock is disabled, tracking is restored to the secondary reference clock, if defined.

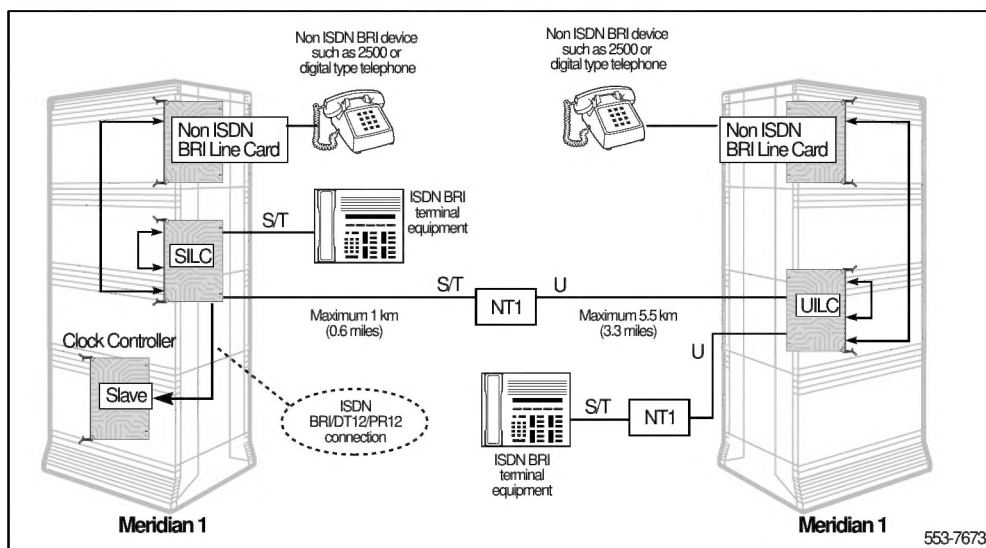
T0 (2B+D) backup for T2 (30B+D)

Note: Japan D70 connectivity uses T0 (2B+D) for T1 (23B+D) backup.

When configuring clock synchronization, ISDN BRI trunks can be configured as backup for ISDN PRI trunks using either ESN Route Selection, or Route Hunting. Clock synchronization may be set up with the ISDN BRI clock source configured as a secondary clock reference for an existing ISDN PRI clock source; and although the reverse is supported, that is, the ISDN BRI clock source may be configured as the primary clock reference with the ISDN PRI clock source as the secondary reference, this configuration is not recommended because a ISDN PRI clock source is more reliable than a ISDN BRI clock source.

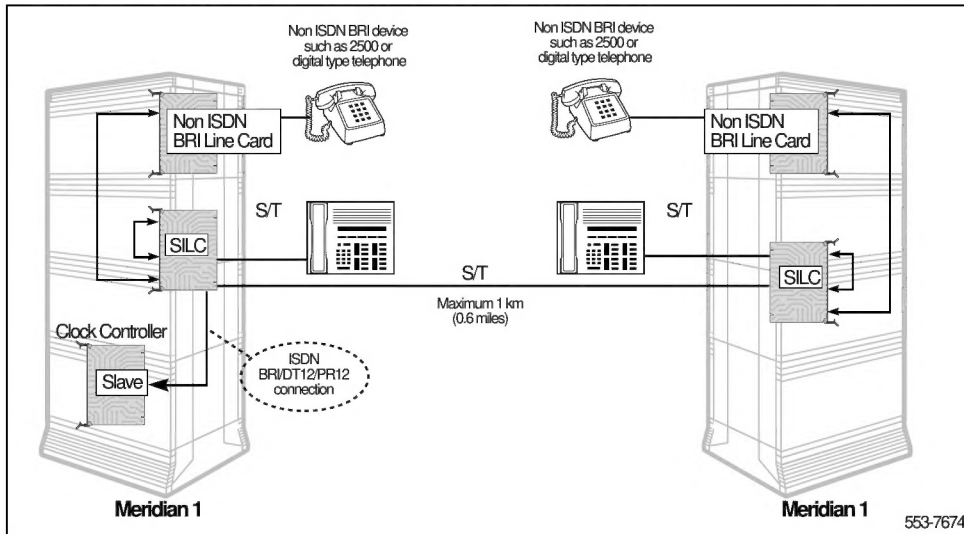
In the second configuration (Figure 11), a MCDN Tie trunk connection may be achieved by connecting two Meridian 1s through an NT1 device. With this configuration, there is a distance limitation of 6.5 km (3.9 miles), without any signal amplification device. System clock synchronization may be achieved by having the Meridian 1, equipped with the SILC, derive clock reference from the ISDN BRI Tie trunk connection or from other ISDN BRI/PRI2/DTI2 connections if available. The Meridian 1 equipped with the UILC interface may be allowed to operate in free-run mode or derive the clock source from other ISDN BRI/PRI2/DTI2 connections if available

Figure 11
ISDN BRI Tie trunk connectivity — second configuration



The third configuration (refer to [Figure 12](#)), although not recommended because of the lack of protection devices and because of the distance limitation of 1 km (0.6 mile), may establish a MCDN Tie trunk link by connecting two Meridian 1s via a direct line between two back-to-back SILC interfaces. This configuration would be applied only to multiple buildings on a contiguous property with no exposed cable (with the 1 km limitation between buildings). System clock synchronization may be achieved by having one of the Meridian 1s derive clock reference from the ISDN BRI Tie trunk connection or from other ISDN BRI/PRI2/DTI2 connections if available. The other Meridian 1 may be allowed to operate in free-run mode or derive the clock source from other ISDN BRI/PRI2/DTI2 connections if available.

Figure 12
ISDN BRI Tie trunk connectivity — third configuration



ISDN BRI QSIG connectivity

The European Computer Manufacturer's Association (ECMA) has defined an ISDN protocol that specifies the Layer 3 signaling requirement for support of circuit switched call control at the "Q" reference point between Private Telecommunications Network Exchanges (PTNXs) connected within a Private Telecommunications Network (PTN). This protocol has been adopted by the European Telecommunications Standards Institute (ETSI) and the International Standards Institute (ISO). Most of the major European PTNX manufacturers will be supporting ISDN BRI (as well as ISDN PRI) connectivity based on the ISDN QSIG (ETSI and ISO) standard.

QSIG is oriented towards signaling and services that occur between peer-to-peer connectivity, that is, between two PBXs, between two Centrex, or between a PBX and a Centrex; the signaling for services would be exchanged across a "Q" reference point. [Figure 13](#) illustrates an example of QSIG trunk connectivity. For ISDN BRI, the QSIG interface will provide the following capabilities:

- Compliant Multi-vendor PBX/Centrex Private ISDN interworking (connectivity between the Private ISDN PBXs may be via PRI or ISDN BRI trunks)
- ETSI or ISO version of basic call service
- 64 kbps clear data
- Overlap Sending/Receiving
- Channel Negotiation

Note: in cases where several ISDN BRI trunks (and hence several DSLs) are configured on a route, if Channel Negotiation fails to yield an acceptable channel on any of these DSLs, it is not possible to use another channel on another DSL.

- Calling Line Identification Presentation (CLIP)
- Calling Line Identification Restriction (CLIR)
- Connected Line Identification Presentation (COLP)
- Connected Line Identification Restriction (COLR)
- Flexible Numbering Plan

- Support for Tie trunk call types
- Transit Count information transmitted when ISDN Call Connection Limitation (ICCL) is present (supported for ETSI QSIG only)
- Party Category (partially supported on ETSI QSIG)

Figure 13 - QSIG ISDN BRI trunk connectivity

